AD_____

Award Number: DAMD17-02-1-0513

TITLE: University of New Mexico Undergraduate Breast Cancer Training Program: Pathway to Research Careers

PRINCIPAL INVESTIGATOR: Jeffrey K. Griffith, Ph.D.

CONTRACTING ORGANIZATION: University of New Mexico Health Science Center
Albuquerque, New Mexico 87131-5041

REPORT DATE: April 2005

TYPE OF REPORT: Annual Summary

PREPARED FOR: U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland 21702-5012

DISTRIBUTION STATEMENT: Approved for Public Release;
Distribution Unlimited

The views, opinions and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy or decision unless so designated by other documentation.

20050819110

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 074-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	April 2005	Annual Summary (1 Apr 2002 - 31 Mar 2005)

4. TITLE AND SUBTITLE
University of New Mexico Undergraduate Breast Cancer Training Program: Pathway to Research Careers

5. FUNDING NUMBERS
DAMD17-02-1-0513

6. AUTHOR(S)
Jeffrey K. Griffith, Ph.D.

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
University of New Mexico Health Science Center
Albuquerque, New Mexico 87131-5041

E-Mail: jkgriffith@salud.unm.edu

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland 21702-5012

10. SPONSORING / MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for Public Release; Distribution Unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 Words)

We have established a three-phase training program to motivate talented undergraduate students, especially students from under-represented Southwestern minorities, to pursue careers in breast cancer research. Phase I provides a well-rounded introduction to the theory and practice of breast cancer research. This phase includes inquiry-based tutorials that integrate key concepts in normal and cancer breast biology; visits to specialized laboratories that utilize state-of-the-art technologies for breast cancer research; structured interactions with surgeons, medical oncologists and their patients, radiologists and pathologists in settings that introduce the clinical realities of breast cancer diagnosis and treatment; seminars presented by the Program's research mentors; a weekly, journal club that introduces current issues in breast cancer research while developing presentation and critical reading skills and a research project supervised by one of the program's mentors. During phases II and III, trainees have opportunities to continue their research projects throughout their senior years, and then in graduate school, respectively. The success of the program will be evaluated in the short term by the satisfaction of the trainees and mentors, and in the longer term by the number of trainees that goes on to graduate studies in breast cancer-related programs.

14. SUBJECT TERMS
Undergraduate breast cancer research training program, minority and underrepresented students, problem-based learning

15. NUMBER OF PAGES
16

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	Unlimited

Table of Contents

Introduction

The objective of the *University of New Mexico Undergraduate Breast Cancer Training Program: Pathway to Research Careers* training program is to encourage and motivate undergraduate students, especially underrepresented Southwestern minority students, to pursue science careers related to breast cancer research. The **specific aim** is to establish a structured, well-rounded training program that provides experiences, tools, knowledge and motivation to pursue careers in breast cancer research. This report identifies the accomplishments and outcomes of the first three years of this training program.

Body

The training plan was divided into three phases. The first phase consisted of an intensive summer training program in which trainees were introduced to the basic molecular concepts necessary for understanding breast cancer biology. In addition, students were provided with an introduction to research practice, and the ethical issues related to research. Students also had an opportunity to talk with patients, view surgeries and visit state-of-the-art service laboratories in addition to beginning their individual research projects in the laboratory of a funded breast cancer investigator. Phases II and III, which are fully supported by the Department of Biochemistry, allow students to progress through their Bachelor's degree and matriculate into graduate or professional school.

The first cadre of 7 students have completed all three phases of the program and have applied to graduate and professional schools. Of these 7 students 4 were supported by this training grant and 3 were supported by the Department of Biochemistry and Molecular Biology. Due to health issues one of the students did not complete the program. All of the remaining students either have graduated or will graduate following the spring 2004 semester. Two students are in their second year of graduate studies at Duke University, two students are continuing in the graduate programs at the University of New Mexico and the remaining two students have been admitted to medical school.

The second cadre of 6 students are either in phase II of the program or have completed their undergraduate studies. Of these students, 3 are still actively involved in the program at the undergraduate level. Two students graduated and will begin Graduate programs at UNM in the fall. The sixth student will begin her second year in the Doctor of Pharmacy program at the University of New Mexico.

The third cadre of 4 students began the program in the summer of 2004. Three of the students are still participating in phase II or III of the program. The fourth student will graduate with honors in biochemistry this spring and is in the process of applying to medical school.

The annual progress on the training program will be reviewed in the context of the 8 Objectives of the original "Statement of Work".

Objective 1: Identify and recruit four sophomore and junior undergraduate students from the University of New Mexico, including women and minority students, to participate in the summer training program.

Recruiting was limited to the University of New Mexico. Recruiting materials were circulated in introductory science classes and a description of the program was available on a web site dedicated to the "Pathways" Program. This web site obtains approximately 45,000 hits per month. A copy of the current advertising brochure is appended to this report. The demographics of all three class are shown in Table 1.

Table 1 Demographics of Pathways Participants

Classification	Summer 2002	Summer 2003	Summer 2004
Gender	Female: 4 Male: 3	Female: 5 Male: 1	Female: 4 Male: 0
Minority	2	4	3
Average years of college	2.5	2.5	2.5
Biochemistry majors	3	2	3
Number completing phase I	6	6	4
Number continuing in phase II or III	0	3	3
Number applying to medical school or graduate school	5	2	1
Number dropping out of the program	1 (Health)	1 (Entered PharmD Program)	0

It was judged that the method of recruiting was successful and a similar procedure has been implemented for all years of the program.

Objective 2: Provide Trainees a broad understanding of the basic concepts necessary to understand breast cancer biology and treatment.

During the first year, a set of 6 inquiry-based training cases was developed to introduce students to the concepts and vocabulary associated with breast cancer research and biology. Not only did the cases raise important biological issues but the students also addressed issues related to research ethics and patient behaviors. During the initial tutorial sessions it was discovered that the students need an opportunity to begin designing experiments, asking experimental questions, and to practice oral presentation skills. Consequently each of the cases were appended to include these training opportunities. Student feedback was extremely positive and the same cases were used in years 2 and 3 of the program. A list of tutorial cases, case objectives and the schedule for the pathways program has been included in the appendix.

Objective 3: Provide Trainees familiarity with state-of-the-art breast cancer research technologies.

Tutorial cases included reference to and data obtained from modern research technologies. At the appropriate time in the cases opportunities to visit the core University service laboratories were made available to the Trainees. These laboratory visits included the Histopathology Laboratory, Microarray Laboratory, Gene Sequencing and Synthesis laboratory, and the Proteomics Facility. In all cases following the visit to the laboratory the students discussed the types of information obtained by these laboratories and the application of that information to their tutorial cases.

Objective 4: Provide Trainees with an understanding of the clinical realities of breast cancer diagnosis and treatment.

All Trainees were provided the opportunity to spend time with a histopathologist, a medical oncologist and his patients, and view a surgery. Following each of these experiences the Trainees discussed their responses and what they gained in understanding from the physician and the patients. It was evident to the faculty of this program that these clinical experiences had an extremely powerful motivational effect on the students.

Objective 5: Provide Trainees opportunities to learn about breast cancer research in the Health Science Center.
Trainees were provided with an opportunity to visit breast cancer research laboratories within the HSC. These tours were not simply to view the facilities but each of the investigators or their research staff provided the students with a discussion of the question under investigation in the laboratory and how they were attempting to obtain answers. In addition, weekly breast cancer seminar series/journal club was developed in which the research mentors either discussed their individual research or discussed a seminal research publication. For these seminars the presenters were charged with formatting the discussion and presentation to the academic level of the Trainees. In addition, following the presentations the Trainees discussed their understanding of the presentation in the context of the tutorial meeting.

Objective 6: Trainees will complete a research project in the laboratory of a funded breast cancer investigator.
During the first two weeks of the program in an informal setting the Trainees were introduced to the research investigators and learned about the available projects. By the end of the two week period students selected a research project. Trainees worked on theses projects during the duration of the summer. A portion of the tutorial sessions were devoted to Trainees discussing their successes and frustrations with their research and updating each other on their progress. The capstone experience of the summer was an opportunity for the Trainees to present the results of their research in a public forum. A list of student presentations is included in the appendix.

Objective 7: Trainees will learn to read and present the breast cancer literature critically.
The summer breast cancer seminar series, described above, alternated with a journal club discussion in which the Trainees read and discussed breast cancer research literature. Students also had opportunities to practice both reading the literature and presenting the papers in the context of the tutorials. Students currently in and completing phases II and III of the program have also had an opportunity to present data at national meetings.

Objective 8: Document satisfaction with the program and track student outcomes.
Through out the summer, weekly "brown bag" discussions were held with the program director. Due to the constructive relationship built between the Trainees and the faculty, these discussions were candid and provided valuable feedback to the program director. The dates of these feedback sessions are listed in the program schedule. Information obtained from the Trainees was frank, professional and obviously aimed at improving the program. The clinical and laboratory tours as well as the tutorial experience were well received by all Trainees. Trainee comments about their own learning, associated with these experiences, were some of the most positive comments ever received by the faculty. As described previously 2 Trainees from the first year experienced difficulty with their mentors. These issues have been addressed with the faculty mentors and we did not experience similar problems with the second or third cadre of students.

Table 2 provides an assessment of the outcomes of the program for the first three groups of students.

Student	Cadre	Graduation Date	Current disposition
Student 1 (Adrian)	1	Spring 2003	Applied to UNM Medical School
Student 2 (Anna)	1	December 2003	Accepted UNM Medical School
Student 3 (Or)	1	Spring 2004	Accepted to Duke University, Biomedical Engineering Graduate Program

Student 4 (Louis)	1	Spring 2004	Accepted to Duke University, Biochemistry Graduate Program
Student 5 (Bridget)	1	Spring 2004	Accepted to UNM Biomedical Sciences Graduate Program
Student 6 (Laura)	1	December 2004	Biology Graduate Program
Student 7 (Raphaela)	1	Withdrew	Withdrew because of health issues. Currently working as a med lab tech.
Student 8 (Chantal)	2	Spring 2005	Applied UNM Biology Graduate Program
Student 9 (Alexandra)	2	Spring 2005	Accepted UNM SOM Biomedical Sciences Graduate Program
Student 10 (Guinevere)	2	Spring 2006	Biochemistry senior – continuing in phase II
Student 11 (Mitchell)	2	Spring 2006	Biochemistry senior – continuing in phase II
Student 12 (Mariza)	2	Spring 2006	Biology Senior – continuing in phase II
Student 13 (Stephanie)	2	Spring 2010	Withdrew from the program to apply to the UNM PharmD program.
Student 14 (Jessica)	3	Spring 2005	Applying to Medical School
Student 15 (Britany)	3	Fall 2005	Applying to Graduate School
Student 16 (Loren)	3	Spring 2006	Biochemistry Senior – continuing in phase II
Student 17 (Brianna)	3	Spring 2007	Biology Junior – continuing in phase II

Key Research Accomplishments

- Development of a formal comprehensive experience for Trainees that focuses on breast cancer research.
- Developed a set of 6 guided inquiry cases to help Trainees learn about breast cancer biology and research skills and ethics.
- Developed a set of laboratory tours and clinical experiences to supplement the training program and provide additional motivation for the students to continue with their research.
- Developed a public research forum for the Trainees to present their research accomplishments.

Reportable Outcomes

- Of the initial 7 students, 6 have graduated and all are continuing on a career path directed toward biomedical research or medicine.
- Of the 6 students in the second cadre, two have graduated and are continuing on a career path directed toward biomedical research. All but one of the remaining students are still actively involved in biomedical research.
- Of the 4 students in the third cadre, two are applying to graduate and medical school, and two are continuing in Phase II of the Program.
- In the 2005 academic year, 3 current students presented research reports at national meetings and I current and 1 former students coauthored per-reviewed papers.

A.M. Fajardo, J.A. Smith, W.C. Hines, J.K. Griffith and M. Bisoffi (2005) *Identification of GS3955 Function in Prostate and Breast Cancer.* **2005 FASEB Experimental Biology Meeting, San Diego, CA.**

J. Wyaco, C.M. Heaphy, and J.K. Griffith (2004) *Telomeric DNA content predicts genomic instability in breast cancer.* **2004 AAAS Symposium, Seattle, WA.**

C. M. Heaphy, C. A. Fordyce, **J. Wyaco** and J.K. Griffith (2004) *Telomere DNA Content in Cancerous and Proximal Histologically Normal Tissues Predicts Disease-free Survival in Breast Cancer Patients.* **27th Annual San Antonio Breast Cancer Symposium, San Antonio, TX.**

C. M. Heaphy, C. A. Fordyce, **J. Wyaco** and J.K. Griffith (2004) *Telomere DNA content is associated with the extent of allelic imbalance in human cancers.* **2004 AACR Symposium, "Telomeres, Telomerase and Cancer", San Francisco, CA.**

J. Wyaco, C. M. Heaphy, M. Bisoffi and J.K. Griffith (2005) *Telomere DNA Content and Allelic Imbalance in Normal, Tumor-adjacent Histologically-normal, and Tumor Prostate Tissue.* **2005 FASEB Experimental Biology Meeting, San Diego, CA.**

Candia B.J., Hines W.C., Griffith J.K., Orlando R.A. (2004). *The Role of Protease Nexin 1 in Breast Cancer Tumor Metastasis.* **Society of Advancement of Chicanos and Native Americans in Science (SACNAS), Austin, TX.**

Candia B.J., Hines W.C., Griffith J.K., Orlando R.A. (2004). *The Role of Protease Nexin 1 in Breast Cancer Tumor Metastasis.* **Alliances for Graduate and the Professoriate Program (AGEP) Colloquium, University of California, San Francisco, San Francisco, CA.**

Atkins, E., Zamora, S., **Candia, B.J.**, Baca, A., and Orlando, R.A. *Human urokinase-type plasminogen activator: Active expression using CHO-S Cells.* ***BMC Biotechnology*, in press, 2005.**

Z. Liu, S. Gu, S. Pan, Z. Jiang, H. Lu, **O. Amit,** E. M. Bradbury, X. Chen and C.-A. A. Hu (2004) *Global investigation of p53-induced apoptosis through quantitative profiling regulatory proteins using comparative amino acid-coded tagging proteomics.* **Mol. Cell. Proteomics, 3, 998-1008.**

Conclusions

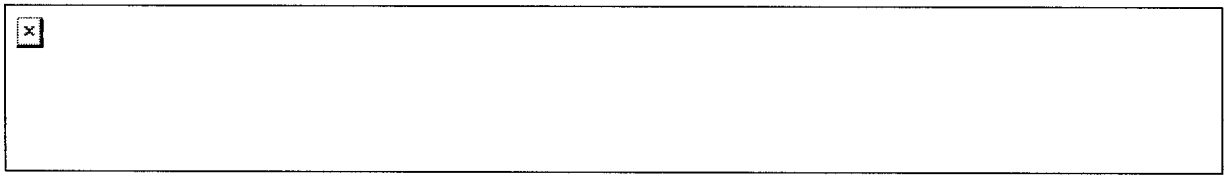
Based on the first and second cadre's graduation rates and career paths selected by the students, this program is considered successful. The third group of students are following a similar course of development. No changes are anticipated in recruiting, laboratory tours, clinical experiences, seminars or the tutorial. Considering that the current UNM graduation rate is approximately at the 50% this program is judged as extremely successful and the faculty are currently investigating methods to make this program available to an increased number of students.

A component of the training program is a public service project designed by the trainees to increase public awareness of Breast Cancer Research or career possibilities. To address this

issue the first year trainees elected to focus on the local UNM undergraduate community. The second cadre of "Pathways" trainees formally chartered the UNM Undergraduate Biomedical Research Association, which is designed to encourage undergraduate students to select biomedical research careers and support them in their academic careers. This is currently an active, formally chartered, UNM student organization. The students in the third cadre of the Program have elected to continue supporting this research effort.

Appendices

Appendix 1: Current advertising brochure



THE PROGRAM

The Department of Biochemistry and Molecular Biology at the University of New Mexico School of Medicine provides full-time summer research opportunities for students entering their sophomore and junior year to conduct breast cancer research in the laboratory of a funded investigator for twelve weeks during June-August. Varied research topics are available to undergraduate students. The breast cancer research projects that trainees may pursue include:

- Development of new antimetastatic drugs
- Tumor suppressor gene function
- Mutational control of gene expression
- Mechanisms of cell death
- Mechanisms of tumor cell metastasis
- Nutritional control of gene expression
- Telomere biology

The program is supported by a training grant from the Department of Defense Breast Cancer Research Training Program. The purpose of the University of New Mexico Breast Cancer Research Training Program is to provide talented undergraduate students, especially students from under-represented Southwestern minorities, the experiences, tools, knowledge and motivation to pursue careers in breast cancer research. The Program includes classroom, clinical and research experiences that will provide a solid foundation for graduate studies and encourage the pursuit of careers in breast cancer research.

DURATION AND FUNDING

The program for undergraduate students offers full-time research experiences for twelve weeks during the summer with a stipend of $4000. There is the possibility of continuation of students' research projects beyond the first s

QUALIFICATIONS OF APPLICANT

Sophomore and Junior students curious about potential careers related to understanding the biology of breast cancer are encouraged to apply for the program. Applicants must have successfully completed general chemistry and general biology courses and be in good academic standing . Student trainees will be selected on the basis of their essay, transcripts, and letters of recommendation.

SPECIAL ACTIVITIES
Participation in the program requires participation in one Research Retreat upon completion of their projects.
Complete the information below and send with your completed application materials to:

HOW TO APPLY

Applicants should submit:

- a one page essay describing why they are interested in the Undergraduate Breast Cancer Summer Research Training Program,
- a description of prior research experience,
- a transcript, and
- three letters of recommendation.

and include contact information

Name:
Address:
City:
State:
Zip:
School:
Telephone:
E-mail address:

Send the above materials to:

PATHWAYS TO RESEARCH CAREERS
Undergraduate Breast Cancer Summer Research Training Program
Department of Biochemistry & Molecular Biology
915 Camino de Salud, NE
Basic Medical Science Building, Room #249
University of New Mexico School of Medicine
Albuquerque, New Mexico 87131-5221

Application materials must be received no later than MARCH 14, 2004.

REVIEW, NOTIFICATION, AND ACCEPTANCE
Applications will be reviewed by an Advisory Committee. All applicants will be notified by April 1st of the results of the review process. Prospective trainees must affirm acceptance of their traineeship within 14 days of notification.

Appendix 2: List of tutorial cases and brief case objectives

Case 1: Angie Landholm

Case Objectives

- Student introductions
- Introduction to problem based learning
- Student identification of cancer related concepts

Case 2: Susan Murdahl

Case Objectives

- Correlate cellular structure with normal structure and function of the breast and changes during pregnancy
- Normal and pregnant histology
- Mechanism of estrogen-dependent cellular proliferation
- Cell Cycle
- Apoptotic mechanisms

Case 3: Joyce Martinez

Case Objectives

- Behavioral issues related to the diagnosis of cancer. How does the diagnosis of cancer affect the patient.
- Introduction to the vocabulary and concepts related to incidents of disease and relative risk.
- What is and what causes cancer: This should be a general discussion that relates back to the discussion of the cell cycle and apoptosis.
- Different kinds of cancer - vocabulary

Case 4: July Peters

Case Objectives

- Epidemiology
- Steps in carcinogenesis
- Molecular Basis of Cancer

Case 5: Cancer Screening Tests

Case Objectives

- Discussed the arguments supporting and rejecting mammography as a routine public screening program.
- Designed a public education program to increase breast cancer awareness.

Case 6: Doris Hernandez

Case Objectives

- Staging of breast cancer
- Treatment options
- Experimental treatment options
- Community resources

Appendix 3: Summer 2004 Pathways Schedule

	Monday	Tuesday	Wednesday	Thursday	Friday
June	**7**	**8**	**9**	**10**	**11**
AM				**Oncology Clinic** 10:00: Group A A. Mangalik, M.D.	**9:00 Microarray** B. Griffith
Noon			**Brown Bag, mentors** A. Hu, Ph.D.	**Brown Bag, mentors** D. VanderJagt, Ph.D.	**Brown Bag, Mentors** H. Hathaway, MD
PM	Tutorial 1:00 - 4:00 **Introduction to the program**		Tutorial 1:00-4:00 **Angie Landholm 305 BMSB**		Tutorial 1:00 - 4:00 **Angie Landholm 305 BMSB**

JUNE	**14**	**15**	**16**	**17**	**18**
AM	**9:00 Molecular Modeling**	**Oncology Clinic** 10:00: Group B A. Mangalik, M.D.	**Proteomics** 9:00 - Group B 10:00 -Group A		**Histology Lab** 9:30: 3rd Floor Lobby N. Joste, M.D.
Noon	**Brown Bag, mentors** Z. Shen, Ph.D.	**Pathways Seminar** R. Orlando, Ph.D.	**Brown Bag, mentors** S. Abcouwer, Ph.D.	**Brown Bag, mentors** M Brenneman, Ph.D.	**Brown Bag, mentors** R. Orlando, Ph.D.
PM	Tutorial 1:00 - 4:00 **Angie Landholm 305 BMSB**		Tutorial 1:00 - 4:00 **Angie Landholm 305 BMSB**		Tutorial 1:00 - 4:00 **Angie Landholm 305 BMSB**

JUNE	21	22	23	24	25
AM					
Noon	**Brown Bag, mentors** J. Griffith, Ph.D.	Pathways Seminar **D. VanderJagt, Ph.D.**			**Brown Bag - Program Assessment Griffith / Anderson**
PM	Tutorial 1:00 - 4:00 **Susan Murdahl 305 BMSB**		Tutorial 1:00 - 4:00 **Susan Murdahl 305 BMSB**		Tutorial 1:00 - 4:00 **Susan Murdahl 305 BMSB**

JUNE	28	29	30	July 1	2
AM					
Noon		Pathways Seminar **Z. Shen, Ph.D.**			
PM	Tutorial **1:00 - 4:00 Joyce Martinez 245 BMSB**		Tutorial **1:00 - 4:00 Joyce Martinez 245 BMSB**		Tutorial **1:00 - 4:00 Joyce Martinez 245 BMSB**

July	5	6	7	8	9
AM					
Noon		Pathways Seminar **W. Anderson Ph.D.**			**Brown Bag - Program Assessment Griffith / Anderson**
PM		Tutorial 1:00 - 4:00 **Julie Peters 245 BMSB**			

JULY	12	13	14	15	16
AM					
Noon		Pathways Seminar **M. Brennemam, Ph.D.**			
PM	Tutorial 1:00 - 4:00 **Julie Peters** **245 BMSB**		Tutorial 1:00 - 4:00 **Julie Peters** **245 BMSB**		

JULY	19	20	21	22	23
AM					
Noon		Pathways Seminar **H. Hathaway, M.D.**			
PM	Tutorial **1:00 - 3:00** **To Screen** **305 BMSB**		Tutorial **1:00 - 3:00** **To Screen** **305 BMSB**		

JULY	26	27	28	29	30
AM					
Noon		Pathways Seminar **A. Hu, Ph.D.**			
PM	Tutorial **1:00 - 3:00** **To Screen** **305 BMSB**		Tutorial **1:00 - 3:00** **Doris Hernandez** **305 BMSB**		

Aug	2	3	4	5	6
AM					
Noon					
PM					**Brown Bag - Program Assessment Griffith / Anderson**

Aug	9	10	11	12	13
AM					
Noon					**POSTERS and PRESENTATIONS**
PM					